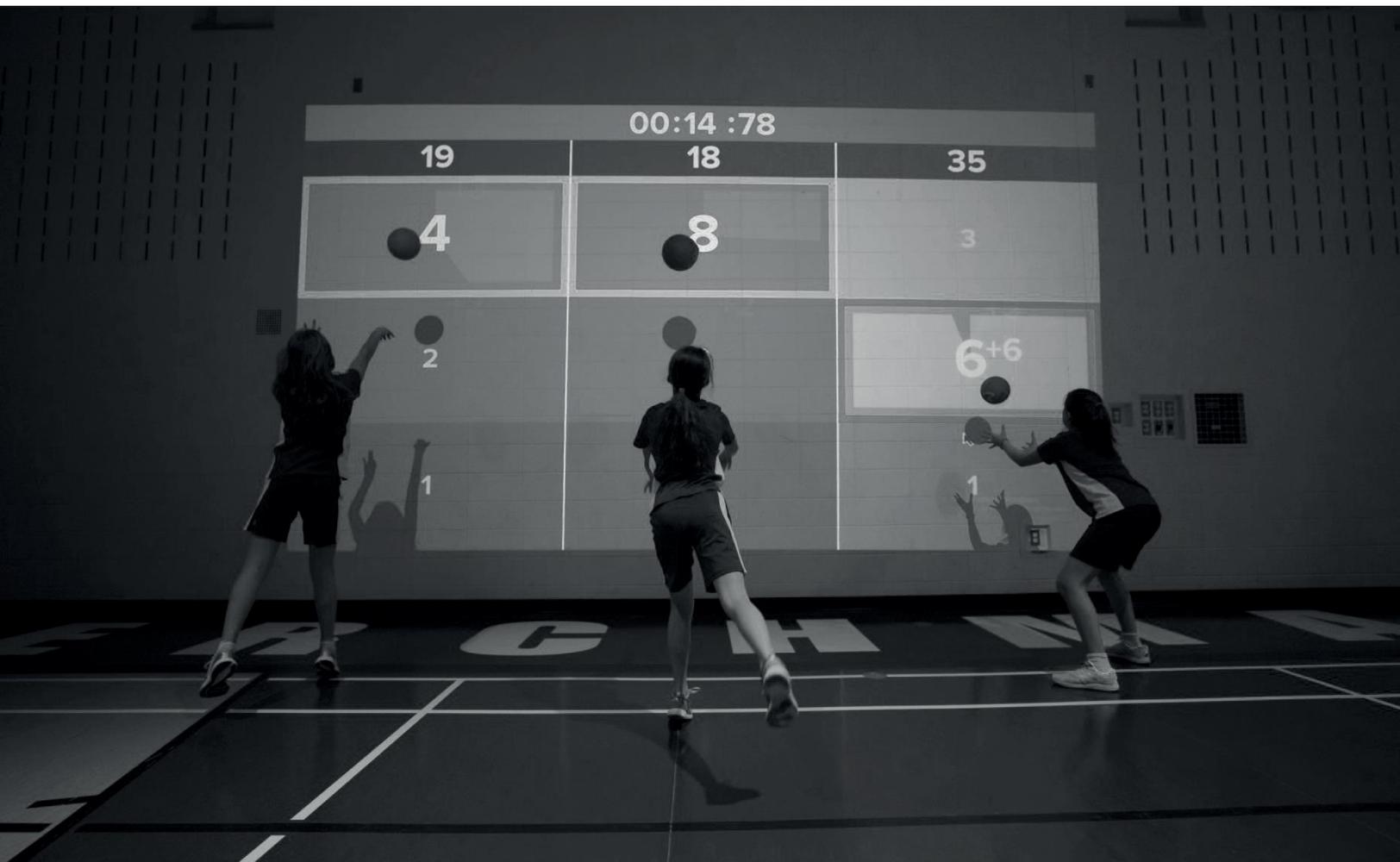


Exercising the Mind and Body: Childhood, Schooling, and Physical Activity

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If we want to help each student succeed, we must refocus our decisions on physical activity and the health and wellness of our children.

On your mark, get set, ready, go!

On your mark, get set, ready, go! These words come to mind when you not only think about the start of relay race; but also, when you think about preparing children and youth for another school year. Thoughts gravitate to how children are expected to progress through the time and experiences that each school brings. Soon after the beginning of a school year, no matter how hard we try or how great the plan, we see the development, continuation, or appearance of learning and performance gaps for far too many. Perhaps the content or skill was presented too quickly, too slowly, or it was too easy, too difficult, or not presented in a way that addressed the variation of learner needs.

Whether in my role at the school superintendent level or as school principal, or teacher, one of the biggest concerns was determining how to create conditions that provided foundations for helping children flourish. It was always difficult to trek through competing demands, while at the same time, keep a laser eye on the instructional intricacies needed to support every child who entered the school door. Some came ready to learn, some came beyond ready, and some just came, seemingly wearing a sign that said, “Ready or not, here I come.” In his seminal work, *Developing Talent for Young People*, Benjamin S. Bloom (1985) identified three pre-conditions for creating successful chances in life. Based on that information, I wrote an article entitled, “The Critical Ingredient to Early Learning” (2015), which explained the significant role that schools, parents, and caregivers play in fostering cognitive, psychological, social/emotional, and preparation for school readiness. Three critical pre-conditions for school and life success were identified: (1) The quality of experiences; (2) The quality of time spent; and (3) The quality

of resources, whatever they may be. Such pre-conditions require deliberate and consistent stimulation, academically, cognitively/intellectually, behaviorally, socially, and emotionally. An additional pre-condition was identified that must start early--- (4) The healthy/physical development and well-being of children.

One of the biggest concerns was determining how to create conditions that provided foundations for helping children flourish.

Public schools are challenged to educate all students to their fullest potential. For several decades now, education reform has relentlessly focused on K-12 common learning standards, increasing college readiness and graduation rates, providing more rigor, focusing on workforce readiness in Science, Technology, Engineering, and Mathematics (STEM), and testing, testing, and testing. Despite that focus, overall academic performance outcomes continue to fall short for a significant number of students. At the same time there has been the reduction and elimination of physical activity and physical education programs in many schools, thus contributing to current generations of children who have little to no physical activity skills (PHIT America (2019)).

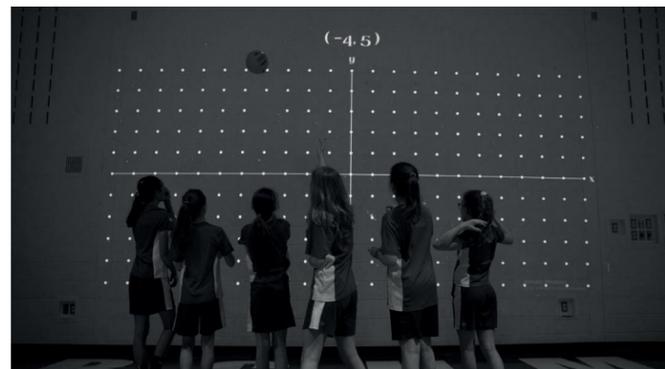
While schools have made progress in identifying and building support systems for academic, behavior, and social/emotional aspects of learning, the area that continues to be omitted from student achievement criteria is the physical well-being of students.

PE teachers commit a great bit of time and expertise to building lifelong fitness and health programs, but if we stay on the same path, we will continue to see disparities in classrooms related to physical inactivity, such as:

- “Sick children who read well.
- Angry children who lash out or bully others.
- Unempathetic children who cannot or will not get along with others.
- Children who have little confidence, social, or relationship skills.
- Children, especially youth who are sedentary, who spend their time on social media rather than participate in physical activity or fitness activities.
- Absent children who miss school regularly due to illness and poor health.
- Children with diseases, or those who are destined for such health risks as heart, stroke, diabetes, lack of bone strength, attention deficits, and other health problems that start developing early”, or
- Undeveloped or under-developed talent of students who do not have access to appropriate physical education, physical activity, sports, wellness, fitness, and health programs (Source Unknown).

childhood to adulthood, we must refocus our decisions on the fourth pre-condition physical activity and the health and wellness of our children. What happens at home and school has a great deal to do with whether a student enjoys good physical and mental health, how happy and satisfied they are with aspects of their life, how connected they are with others, and how they form a vision for their future. As educators and parents, we have the awesome responsibility of determining how we can meet the needs of the rising generation; therefore, the question must be asked, “Are we shaping or forming young people who will thrive in these and future times.

An adage comes to mind, “A sound body leads to a sound mind.” In translation, the message is “if you look after your body, your mind will benefit also. (Source Unknown). The adage still rings true today. According to John Locke, a sound mind means having the capacity to think in realistic and reasonable terms to advance. A sound body means that you can physically do whatever your mind has put forth as the right thing. The mind (the brain) and the body must operate in harmony, starting early and throughout adulthood. It is easier to establish healthy behaviors during childhood, than intervene or reverse unhealthy behaviors during adulthood. Such an adage still rings true today.



In the past, the concern for the physical health and welfare of children was of high priority in schools. The onset of the 21st century surfaced new priorities and challenges that have adversely affected the future of children. If indeed, we want to help each student succeed from

The Challenge and the Opportunity

Regular physical activity in childhood and adolescence is important for promoting life and health well-being (National Center for Chronic Disease Prevention and Health Promotion, 2018). Physical activity has been defined as “anything that moves your body and burns calories.” This includes exercise, walking, climbing stairs, stretching, bicycling, swimming, dancing, running, etc. Consider a class that improves children’s health and fitness, self-confidence, and interpersonal skills, and provides access to powerful instructional strategies that improve a child’s academic and physical abilities. Such a vision is clouded by the fact that approximately one out of three youth engage in recommended levels of physical activity at home and at school (Urban Institute, Child Trends, 2002).

A 2018 Physical Activity Council (PAC) study of 30,999 Americans, noted that in recent years, the U.S. has been moving from a sedentary life to one that is more active, and healthy; however, the problem is that the advent and impact of time spent on technology, the Internet, and social media has created an even greater sedentary tendency for children and youth globally. The good news is that the PAC study found that “more than one-third of the respondents reported they received Physical Education (PE) in school, and due to that exposure, they remained active to at least a “healthy level.” The study reported, also, that families from lower socio-economic levels depend on schools for accessing opportunities for sports, health and physical education. This sparked a critical question that was posed in the PAC study: “Since PE is a predictor of activity in adulthood, and lower income households depend on PE as their source of fitness, how is it that PE [and recess] continue to disappear in U.S. schools?”

As schools seek to help students tap into their potential, all aspects of development must be integrated into the learning process. “In July of 2012, The Lancet, the leading publication on global health, called physical inactivity “a pandemic with far-reaching health, economic, environmental and social consequences” (PHIT America 2018, 2019). Due to the inactivity pandemic,” children born after September 11, 2001 (Generation Z), are affected by two major challenges that schools must face. As stated by the Centers for Disease Control and Prevention (2010):

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“Children who are physically active and fit tend to perform better in the classroom, but many schools allow little to no time for student to be active.”

“Allocating time for daily physical education does not hurt academic performance, and regular exercise may improve students’ concentration and cognitive functioning”

But the question is how? More and more policymakers and educational leaders are mandating that schools provide a “well-rounded” education, including access to Health and Physical Education. Worldwide, people are becoming more aware that students are suffering from childhood health risks, including an obesity and sedentary lifestyle crisis, but often, the severity of the problem is not fully understood. PHIT America (2018) reported that in 2017, “the life expectancy in the USA went down for the second straight year. Nancy Brown, CEO of the American Heart Association, reported that: “The disparities in obesity rates among blacks and Hispanics, both young and old, are shocking – we can and must do better...” In 2004, Former U.S. Surgeon General, Richard H. Carmona pinpointed the most frightening impact of the inactivity crisis:

“Because of the increasing rates of obesity, unhealthy eating habits, and [lack of] physical activity, we may see the first generation that will be less healthy and have a shorter life expectancy than their parents” (Action for Healthy Kids, 2012).

In addition to health risks, there are learning, attention, and school performance issues, including hyperactivity, mental, social, behavior, and emotional needs.

Many schools and school districts in the U.S have reduced and eliminated physical education programs, which has contributed to adverse conditions for children and youth. For example:

- “48% of all high schools have no physical education (PE);
- The average budget for PE for an entire year is \$764 per year;
- The average budget for an elementary school PE budget is only \$460 per year;
- Recess has been eliminated in many schools;
- With the advent of the ‘No Child Left Behind’ federal legislation passed in 2001 in the US, schools focused more on academics;
- School days were extended to focus on academics;
- P.E. and other activity breaks have been cut to focus on education [It should be noted that P.E. was not considered as a part of what is considered “education”]; and,
- Today, 75% of all teens are not fit enough to join the military” (PHIT America, 2018).

When considering the international picture, one can review information from the Active Healthy Kids Scotland Report Card (2013), which closely aligns with Active Healthy Kids Canada Report Card. The Scotland Report found that Scottish children and adolescents had extremely high levels of recreational screen time and low levels of moderate to vigorous levels of physical activity. A lifestyle consisting of poor diet, low physical activity and overweight or obesity were the norm for the students (Reilly, Dick, McNeill, and Tremblay (2014).

There are parental worries. Childhood inactivity was recently voted the #1 concern of parents because of the impact it is having on children and families in the country (PHIT America, 2019). While more emphasis in the U.S. has been placed on mathematics and reading in school, a Harvard Health Forum State of PE Report (HPSH, 2013) found that “91 % of parents feel there should be more physical education in school, particularly to fight obesity. “Almost seven in ten [of parents polled] said their child’s school does not provide daily physical education even though experts recommend 150 to 225 minutes per school week” (Harvard School of Public Health, 2019).

The severity of the “physical inactivity” problem offers new opportunities to intervene and improve life chances for children and youth; but first we must have a clear understanding of the “what, why, and “how to accomplish this task. It sounds simple, but in the contemporary landscape, a focus on physical activity has proven elusive in the two places that have the greatest influence on learning basic physical activity skills and the importance of fitness—in schools and in the home.

Educating Physically Literate, Healthy Students—Whole Child Learning

We must begin by asking such questions as: What constitutes a quality wellness and Physical Education (PE) program? And, how can educators work with others to ensure that opportunities are readily available for child-

ren to learn how to lead healthy, active lives?” Most children have a high degree of learning potential, therefore, incorporating as much physical activity and enjoyment as possible in a child’s day in and out-of-school is essential. We must determine how we can best help physical educators help students gain confidence in a variety of forms of physical activity—dance, sports, swimming, running, recreation, and the like; and how we can connect that learning to academic achievement outcomes, and make learning more relevant, inclusive, responsive and fun. And, finally we must determine how to effectively connect brain compatibility and movement and incorporate digital age learning into the physical education environment so that it becomes value-added to the learning process.

This is a tall order, but it is the necessary work of school leaders, physical educators, and others who are concerned about the need to intensify different types of movement and active learning opportunities. The goal is to provide a holistic approach by providing a consistent, supportive, developmentally appropriate, enjoyable, physically active learning environment, that addresses comprehensive, engaging, standards-based, and technologically rich health and physical education. Such experiences should respond to the widest range of students possible, so they will benefit physically, mentally/cognitively/intellectually, and affectively (socially, behaviorally, and emotionally).

As a prerequisite for increasing school performance, more consideration must be given to prioritizing and promoting physical activity, exercise, and physical education, as an integral component of childhood and schooling. We must begin by exploring how to get more deeply into understanding the learning process so we can be

more effective in addressing what is needed for now and the future. Physical educators and coaches often agree, that in addition to improving academic performance, time in the school day dedicated to recess, physical education classes, and active extra-curricular activities can increase physical literacy and the long-term attitudes, habits, and life goals of students (Kohl & Cook, 2013).

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At the center of responsive school improvement are “whole child” and “whole school” principles and beliefs that schools are common places where healthy eating, physical activity, safety, and physical education can be reinforced for the masses.

Educators have been experimenting with how to inspire students to have passion and enthusiasm for core subject matter content. Health and Physical Education (PE) teachers frequently are asked to contribute to student achievement in areas of STEM and Literacy. Several efforts have been successful and brought increased engagement and impact into teaching and learning; but unfortunately, there have not been too many successful attempts to pair core content, such as science or geo-

metry with music, sports, or physical education, or integrate physical education with math and social studies. A great deal of time and effort have been spent on trying to help teachers change their practice and increase interests, motivation, and outcomes for students in core subject areas, such as Language Arts/Reading, Mathematics, Science, and Social Studies. Unfortunately, for the most part, Physical Education has not been a part of the conversation.

The Association of Supervision and Curriculum Development (ASCD) noted that health and PE are often seen as two distinct disciplines that complement one another. School wellness must be brought to center stage through greater alignment and collaboration between Health and PE, and more attention must be paid to physical activity and Physical Education (PE) as important core subjects that are required for every child in school. Physical education must be a place where children look forward to having fun and return to a class with anticipation, energy, and positive attitudes; therefore, we must understand what motivates students so that we can incorporate a coordinated effort to provide vigorous physical activities that appeal to both males and females.

It’s just good for kids and schools

Children are of the greatest concern. Although there has been a decrease in physical education and recess in many American schools, at the same time, there has been an increase in the onset of diseases in children and adolescents, such as diabetes. Diagnoses of ADHD and

the numbers of obese and overweight children have increased. We have seen an increase in classroom management problems, that often are related to the inability of the executive function of the brain to regulate emotions, organize, and focus on memory, multi-tasking, and influence the ability to behave as expected.

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PHIT America (2018) shared that “declines in physical activity are accelerating, especially with 6-12-year-olds, ... and kids have not learned basic physical activity skills and the importance of fitness... in their homes or in education programs in school. A growing body of evidence indicates that physical activity, fitness, and exercise have positive effects on overall well-being, which is significant for students who do not have access to in-and out-of-school physical activity or for those who have learning limitations. Students often report they are disengaged, bored, or do not think what is being taught in school is relevant to their lives. Such attitudes might be influenced

by the sedentary approach to education. It has been suggested by Brad Johnson that physical inactivity might be the reason students’ creativity and intelligence are hindered throughout their formative years. “Until the age of 4, children are continually playing and learning in a state of motion, “but when they enter formal school [and sometimes pre-school], the focus shifts to uniformity, control, following rules, and sitting at desks” (Johnson, 2019).

The 2015 Program for International Assessment (PISA) Study focused on life satisfaction and overall well-being of 15-year-olds, and what contributed to their happiness and welfare at home, school, and in the community, psychologically, physically cognitively, and socially. In many cases, physical activities in this study involved playing sports in and out of school, which varied across countries. Some schools offered three (3) or more days, such as Hungary, Poland, Russia, Canada, Japan, New Zealand, the U.S., Bulgaria, and Australia. Others offered zero days, such as Belgium, the Netherlands, Germany, Ireland, Spain, Chinese Taipei, Estonia, Croatia, Hong Kong (China), and Costa Rico. Most other countries offered between two or one day of physical education in school (OECD, 2017).



In countries where schools or out-of-school activities offered moderate to vigorous physical activity most consistently, students were more satisfied with their life and well-being.

This included how they felt about academic tasks and outcomes, behavior and social relationships, health and mental health issues such as bullying, and connections at home and at school with teachers, parents, and friends. Andreas Schleicher, OECD Director of Education noted the life satisfaction and success for both girls and boys in most countries was higher for students who were engaged in physical activity.

The overall contributing factors for life satisfaction and well-being were:

- Students who talked or met with friends after school;
- The level of physical activity;
- Good teacher support at school; and
- Good parental support at home.

The research is clear

By now, educational leaders and teachers are probably wondering, “When can I find time to add another critical area, and where is the evidence that connects physical activity and physical education to student performance and expected academic outcomes?” Whether considering physical education, physical activity, recess, or before and after school programs, a great deal of research

supports a renewed focus on physical activity and education. Over the past 30 years, mounting research validates that inactivity negatively effects the brain, body, and the ability to learn. This includes eating improperly, being obese or overweight, participating in little to no exercise, recreational, or sports activities, using tobacco or drugs, and living a sedentary lifestyle involving spending too much time sitting and engaging in television watching, online video games, and laptop and smartphone time on Twitter, Facebook, Instagram, Snapchat or whatever the latest social media forum.

There are negative consequences to physical inactivity

Research confirms several factors related to physical activity and physical education that have significant impacts on a child’s health and school performance. Physical inactivity has been ranked the 4th leading cause of death, just ahead of high blood pressure, tobacco use, and high pressure in that order (PHIT America, 2018). Physical inactivity leads the fifth cause of death, overweight and obesity; therefore, it can suffice to say that physical inactivity has a relationship to the top five ranked causes of death by the World Health Organization (2002). The number of children who are physically active continues to decline, including participation in sports. “Inactive children mean increased health issues and costs ... and it means that children are missing school and are not performing well academically (PHIT America, 2018).

According to World Health Organization (2002), about 2 million people of all ages, worldwide, die from conditions related to sedentary lifestyle. Some of the related health problems are hypertension (high blood pressure), stroke, kidney and heart diseases. Physical activity and regular exercise can counteract such threats by helping to pump the blood more efficiently throughout the body. Other impacts on the body include high cholesterol level (physical activity can increase HDL (good) cholesterol); and osteoporosis (physical activity helps strengthen the bones). Other common health risks are colon cancer (waste moves through the colon slower when people are sedentary); and breast cancer (hormone levels may be lower with regular exercise, which can decrease the chance of developing breast tumors) (CDC, 2019).

In the article, “Right the Wrongs of Sedentary Education” (2019), Johnson noted that:

Students need to be “on their feet” moving, dancing, stretching, marching, walking, running, and active in other ways, because “the part of the brain that processes movement also processes learning.

The benefits of routinely engaging children in physical activity and fitness were summarized by Johnson (2019, p. 33):

- “The brain works best when used in tandem with the body.
- Children are designed to be moving and active.
- Active and fit children perform better academically.

- Exercise releases endorphins, which help children feel better and relax.
- Different aspects of intelligence and genius are magnified through movement and creative learning.
- Increased physical activity is a great classroom management tool.
- Sedentary education is the greatest disservice we have done to children in the last generation.”

It’s just good for the brain

The higher intensity the exercise or physical activity, the more chances for producing a sharper brain, which increases the readiness to learn (Hillman, 2015 in PHIT America 2018). Medical and brain science dictates that exercise and physical activity are critical to developing the potential to learn and function as successful learners and adults. Engaging in consistent physical activity can have long-term benefits on increasing the chance for better health and brain development and functioning. Erickson, Hillman, and Kramer (2015) explained that physical activity is one of the factors that influences both the capability and range of brain plasticity throughout life. Physical activity and exercise anchors learning of the frontal lobe where more senses are involved to increase the Executive Function (organization, attention, planning, sequencing, problem-solving, working memory, cognitive flexibility, abstract thinking, rule acquisition, selecting relevant sensory information; regulation: initiation of action, self-control, emotional regulation, monitoring internal and external stimuli, initiating and inhibiting context-specific behavior, moral reasoning, decision-making) (University of California, 2019).

In, SPARK, The Revolutionary New Science of Exercise and the Brain, author, John Ratey (2016), concluded that movement allows us to activate parts of the brain that create the potential for successful learning and achievement. Physical activity and exercise (a) Gets the brain’s fuel (oxygen and glucose) to the brain faster boosting brain performance; (b) Puts the brain back into hormonal balance which regulates mood and behavior; (c) Activates protein that is stored in the large muscles, which nourishes and protects the neural pathways; (d) Improves the ability to learn, and in fact, makes us smarter; and (e) Grows new brain cells in the learning and memory center.

Composite of 20 student brains taking the same test



It benefits cognitive/mental development

Students who are inactive for long periods show hindered cognitive development, which “results in poor performance, memory and limited attention span (University of California, 2019). When the brain is stimulated, it influences cognition (ways we acquire knowledge understanding, and thought), the growth of mental abilities (attending, perceiving, observing, remembering, imagining, thinking, solving problems, and the growth of language

and intelligence. These abilities are interdependent, and are developed through stimulation, experiences, maturity, and stages and phases of individual growth and development. The U.S. Department of Health and Human Services (2018) recommended that children and adolescents ages 6 to 17 years do 60 minutes or more of moderate-to-vigorous physical activity daily. In addition to fitness, such exercise improves overall cognitive development, concentration, performance, memory, and skills, such as sequencing, following directions, and critical thinking.

Kohl & Cook (2013) provided insight that single sessions or long-term participation in physical activity improves cognitive performance and brain health. Long-standing evidence suggests that students learn and process information through auditory, visual, and kinesthetic methods; therefore, physical activity and physical education increase kinesthetic, physical, and cognitive learning, which increases enjoyment, motivation, relevance and understanding.

There are academic benefits

In a correlation study of three (3) million children in schools in California and Texas. Charles Hillman (University of Illinois, Urbana, 2015) observed brain images that reflected the side effects of students engaged in physical activity (walking) versus those who were not involved in movement. Hillman concluded that the brain lit up after two minutes of walking; in contrast, brain images did not light up of children who did not engage in physical activity (walking). Additionally, evidence suggests that mathematics and reading are the

academic topics that are most influenced by physical activity (Kohl & Cook (2013). According to Active Living (2015), “Even single lessons of physical activity have been associated with learning outcomes in mathematics, reading, and writing, better scores on academic tests, improved concentration, memory, and retention.

Executive function and brain health underlie academic performance, and basic cognitive function relates to attention and memory. Such functions are enhanced by physical activity and higher aerobic fitness. Several key interrelationships of academic achievement to physical education, physical activity, and sports programs were explained by Francois Trudeau and Roy Shepard (2008). The authors concluded “it is possible to add physical activities to the school curriculum by reducing time in other subjects without hindering academic achievement. However, taking time for a physical education program to add to academic subjects, does not enhance grades in academic subjects. In fact, reductions in physical activities may cause student performance to decline because the time in class exceeds the student’s ability to focus and absorb complex concepts” (San Diego Figure Skating Communications).

There are psychological and social/emotional benefits

Engaging in adequate physical exercise is known to bring positive changes in mood, lower stress levels, and develops social skills, which, affects cognitive development. Increased physical activity can be a tool for learning to focus and remain well and calm also

(Berdik, 2019). Current research connects physical activity to such issues as lack of social-emotional skills, lack of interpersonal and social connectedness, lack of self-regulation, and absenteeism, and drop-out rates in school. Movement and tactile/kinesthetic learning are known to produce fewer behavior problems/referrals.

Physical activity and exercise are known to contribute to psychological well-being, including self-confidence and higher self-esteem. It stimulates the brain and spurs emotional connections to students’ habits, attitudes, values, goals, interpersonal skills, and feelings of empathy. It connects to passion interests, and engagement, which supports the overall goal of learning, and can increase attachment to school and self-esteem (Trudeau and Shepard (2008).

As reported in Active Based Learning, 2015, “Almost immediately after engaging in physical activity, children are better able to concentrate on classroom tasks, which enhances learning.” When children are sedentary, their energy level is down. When they are not involved in fitness and movement, their mood and behavior patterns are erratic. When they are engaged in regular physical activity, they learn self-discipline, leadership and cooperation with others. There is a growing trend to increase aerobics and incorporate mindful techniques in Physical Education classes, such as “brain” breaks, yoga, stretching, and meditation strategies.

Stress reduction is an outlet for releasing tension and anxiety, and combined with physical activity, it can strengthen peer relationships. Also, such activities are associated with changes in gray matter concentration in brain regions that are involved in learning, memory processes, emotion regulation, and stress reduction (Hölzel, Carmody, Vangel, Congleton, Yerramsetti, Gard, & Lazar, 2010).

Mindful strategies, such as deep breathing and attending to physical activity that strengthens social-emotional abilities are linked to improved heart, brain, digestive, and immune system function; all of which are related to lowering anxiety, minimizing negative emotions, and improving concentration and happiness (The Greater Good Science Center (2019).

Learning that is technologically mediated

If appropriately designed and used, technology, digital tools and video games can provide positive learning experiences for children and youth. Integrating technology and gamification in lessons increases the possibilities for student understanding and enriches content and skills that can motivate students to participate in physical activity and learning tasks. Gamification is generally known as using game design and mechanics to enhance non-game contexts to increase engagement and participation. Well-designed gamification strategies can be integrated with curriculum and fitness concepts, thus allowing the transformation of a traditional classroom into one that incorporates technology as a part of the curriculum. Gamification and other uses of technology can help students demonstrate understanding, as well as, increase opportunities for collaboration, cooperation, inclusion, reinforcement, and practice.

There are some critics of the use of increased technology and gamification in schools due to the impact of the sedentary nature of its use, and the infatuation of use that increases more and more screen time and inactivity of children and adolescents. However, when implemented

appropriately, digital-age and game-based learning (gamification) in education is supported by strong evidence.

Technology and gamification are known to increase the release of Dopamine, a neurotransmitter that controls the part of the brain that is responsible for enjoyment and pleasure.

Gamification is known to increase core brain activity, which allows for increased brain development; and addresses learning styles, (a) “Visually, by using processes that rely on images and mind maps; (b) Auditorily, by using sound, music, and rhythms; (c) Physically or learning by doing; (d) verbally, by using speech and language; (e) Logically, by relying on reasoning to help see the big picture; (f) Socially through group learning;” and, (g) Independently (learning alone or through self-study (Lynch, 2017).

While enjoyment and pleasure are desired goals, the focus of using technology and gamification must be to keep teaching and learning standards at the center of lesson design. First, the learning objectives should be identified, then the design of game content and mechanics should focus on the specific learning goals. The nature of how the game is played should deliver the learning goals and objectives. Finally, a determination must be made to show how results will be measured to meet the objectives. There are some critics who are concerned about the focus on extrinsic feedback and rewards, such as points or winning, which are components of gamification. Some believe that a focus on extrinsic motivation and feedback deters the ability to develop intrinsic motivation as a factor for self-regulation and engagement.

Holloway (2018) noted that games should not be used as a replacement for pedagogy or for external motivation solely, but as an enhancer to the overall learning experience. Still, critics have the concern that introducing more screen time activities into the classroom contributes to children's already excessive access to technology. The difference in using gamification and high-tech learning strategies in Physical Education, is that digital game design and mechanics can be embedded with physically active learning goals and objectives that relate to health and fitness as underlying components of game and learning experience. In fact, some studies have found that when students use games as a part of learning, they did better than those who did not. The caveat depended on the degree to which the game design was better, and how effective specific learning goals were incorporated into the game (Banville, 2013).

The Best of All Worlds

School gymnasiums have been the same for the past 50+ years, so the time is ripe for creativity, interdisciplinary transformation, and relevant change, including the use of immersive technology and digital resources and strategies. The gym is like an empty canvas that is awaiting attention. With the right equipment, resources, and approaches to instruction, it can be a learning environment where more kids can enjoy learning that is embedded with physical activity, fitness, health.

Visualize the potential of creating an innovative learning environment that transforms the Physical Education classroom (the gym) into a place that demonstrates appropriate fitness and consistent engagement in physical activity and PE. Imagine attending a class in the gym that

ignites 21st century learning, student engagement, and cross-curricular content in support of increased academic performance. Imagine the PE classroom, the gym, where students are anxious to attend, participate, and just have plain fun while learning.

Envision a learning environment (the gym) that addresses what brain science and research tells us about the relationship between the brain and the body. And think about the power of classrooms that make strong connections between Health, Physical Education, physical activity; and strengthens academic learning and improves memory, motivation, engagement, and social-emotional abilities.

Meet Lü Interactive Playground

Lü Interactive Playground is a technology resource that has the main goal of integrating movement, fun, and physical activity into physical education. Starting in the gymnasium, LU supports the vision that a healthy mind is only possible if there is a healthy body. Using an online ecosystem, Lü provides breakthrough classroom activities that connect to forward-thinking educators. Lü transforms traditional school PE classrooms into interactive learning environments using well-designed activities (content) and a powerful audiovisual, multi-sensory infrastructure. The vision of Lü asserts its role in leading transformation of Physical Education through understanding the interrelationships of leveraging technology with whole child learning.

Lü Interactive Playground engages children in a new way that is inclusive (more children are willing to participate

in physical activity), immersive (more students are deeply engaged in relevant 21st century learning), and one that exercises the mind and brain (more children have access to whole child learning in physical education).

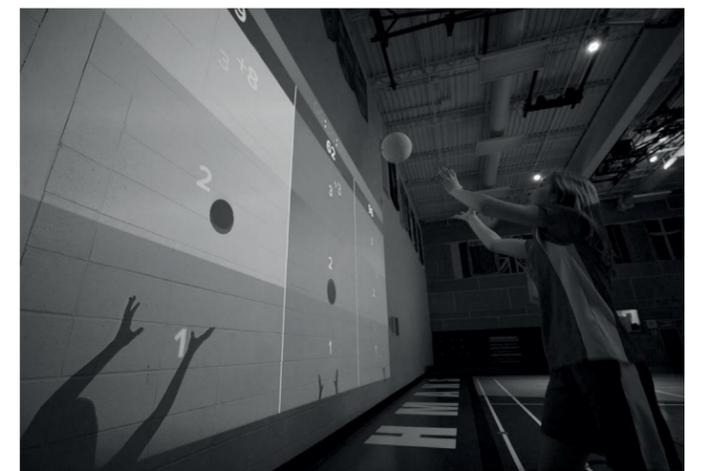


The Lü Interactive Gym is a smart space that understands, in real time, the behaviors and interactions of people within the transformed environment. The mission is the desire to increase the potential for children's success based on three whole child principles: (1) Physical Health (movement, motor skills, fitness, health and wellness); (2) Mental/Intellectual Health (Increasing the executive functions of the brain to increase skills and abilities in Literacy, Numeracy, Social Studies, Science, Health/PE, Music, Art), and (3) Social/Emotional Health (self-esteem, confidence, emotions, self-regulation, motivation, engagement, interests, behavior and attitudes).

By integrating interactive learning and pedagogical digital games integrated with physical activity, LU has reversed the trend of the sedentary nature of online screen time. Kids learn through an approach that incorporates physical/movement, fitness, social-emotional, the integration of technology, and academic skills simultaneously. Giant video games and interactive lighting create an engaging experience for players; so much so, they often forget how intensely they are exercising! Lü takes 21st century learning to the next level using integrated hardware

and software that brings learning to a new height. Using information coming from ceiling mounted 3D cameras, learning tasks linked to academic and fitness standards, games, and physical education tasks and tools are projected on a giant wall. Synchronized lighting and sound effects are integrated for immediate feedback and an immersive experience that captures the interests of today's students.

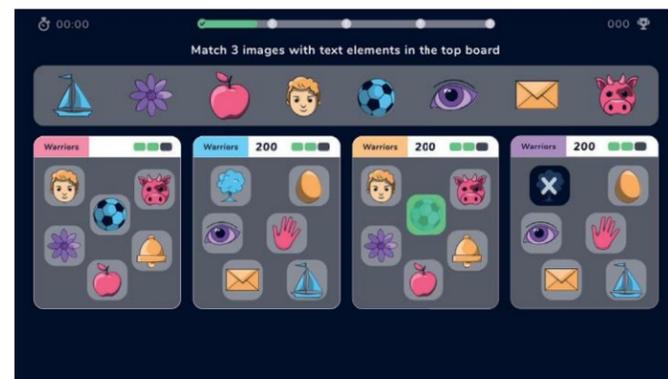
Lü brings together in one place multi-media, multi-sensory, multi-modal learning devices that access digital activities (apps) and Internet content that can be integrated into the delivery of instruction. What makes Lü so innovative is the merging of the power of computer images, sound, and projections can be presented in individual, small or large group or multi-purpose classrooms. Interactive data is captured by the technology from the ceiling mounted 3D camera and wall projections. As students aim and throw balls at specific targets, the balls interact with magical displays of images of content, such as fitness and sports games or activities, math problems, spelling lessons, social studies, science, health, music, meditation, dance (activity breaks or warm-ups), nutrition, and utility tools, such as monitors, scorekeepers, timers, and the like.



The Design Principles: APPs/Learning Activities and Tools

The Lü Interactive Gym is likened to a “MAGIC BOX”—a room full of resources for people that include subject matter, activities, experiences, skills, utilities (digital tools) and enjoyment all related to physical activity, childhood fitness, academic and physical development and success. The platform includes an operating system which opens a “Magic Box” full of synergetic holistic learning experiences intended for the gym, the classroom and the whole school. Lü is available in three integrated configurations, (UNO, DUO, and Mobile Unit). Each includes an ever-growing selection of high-quality educational gaming content that has been and continues to be developed based on creative ideas, input and feedback from PE teachers, curriculum specialists, product developers, students, and others. Depending on the configuration, the UNO, DUO and Mobile Unit require at least one interactive wall that can serve large to smaller spaces.

As opposed to individual components, the LU Learning System contains (a) interactive video wall lights and sound systems, (b) computer, video projector video camera, 6x static lights computerized lights, audio speakers, remote control, USB Keyboard Factory Installation Kit, (additional installation gear is required) (c) Teacher tools: targets, web browser, stop watch, UNO, DUO or MOBILE UNIT games, and access to new applications (lessons/activities) are being designed on-going.



Lü responds to evidenced-based research

The magic behind the Lü Interactive Gym is not what children immediately see. Standards-based lesson activities (apps) are presented so that challenge and interest can be ignited through teamwork and immediate feedback. Embedded in the software (apps) are design principles involving neuroscience, education, health, and medical research linked to Physical Education and academic learning standards at various levels of difficulty. Lu provides opportunities for more engagement in standards-based curriculum content and learning. Lesson, activities and apps respond to different ways students learn. Many of the activities can be modified or adapted for students with various challenges and learning difficulties/disabilities.

The learning system is designed to address the “how to” of transforming the PE classroom. Some of the educational benefits include developing the ability for teachers to:

- Translate effective learning theory and learning concepts into practice by integrating academic, digital-age,

and kinesthetic learning through movement and physical activity;

- Integrate gamification to activate, strengthen, and promote engagement in health, sports, fitness, and physical education leading to achieving a quality active lifestyle;
- Provide an environment that focuses on the parts of the brain and the body that benefit from motor skills, spatial ability, and coordination, linked to social, emotional, and cognitive stimulation and interaction;

Interwoven in the learning activities are lesson components or skills that can be aligned with curriculum learning standards and grade level benchmarks, such as U.S. Common Core or State Standards, International Baccalaureate (IB), and International/SHAPE America Physical Health and Education Learning Standards. For example, the app, CONSTELLO, shows the relationship between two numeric patterns that must be solved through individual and team play, which addresses U.S. Common Core and State Standard CCSS. Math Content 5.G.G.2: Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and intercept coordinate values of points in the context of the situation. An ICHPER.SD and SHAPE America National PE Learning Standard addressed is Standard 1: S1. E.5b: Combines locomotor and manipulative skills in a variety of practice tasks/game environment at grade 5, for example.

Lü makes physical activity fun

Lü can turn any gym into a movie theatre, a stage, a dance floor, community event, and more; therefore, the gym can

serve many purposes besides sports and physical education classes. Teachers and users have reported high levels of enthusiasm and enjoyment for Lü Interactive Gyms. This engagement and learning can be translated into effective, purposeful, and creative teaching and learning. Students have a better chance to demonstrate their abilities within a collaborative and team learning environment. This offers learners a chance to keep up with peers, extend or develop understanding of how to process new information in different environments, solve problems, practice, learn new information, or apply information with new and sometimes more challenging content and physical skills.

Lü can turn any gym into a movie theatre, a stage, a dance floor, community event, and more.

Lü is interested in impacting the data

As the numbers of users continue to increase in the US and globally, the next step is to partner and engage in research to formally test and validate the effects of game-based apps and the Lü Learning System. Judging from the positive responses and testimonials from current users, teachers and educational leaders are pleased, and students are ecstatically engaged in the use of Lü for teaching and learning. Teachers have reported they see a difference in student behavior, attention, participation, and learning. Among the many schools involved in the magic, students at Belgreen Elementary in Franklin County, Alabama, USA are already experiencing the benefits of the Lü interactive playground as noted in the comments of School Superintendent, Greg Hamilton:

“The Lü Interactive Playground not only provides health benefits, it also provides quality, learning engagement.”
“The enthusiasm from the students has been exciting.” Another benefit of a system which combines physical education and learning, is the engagement of all students. It allows for inclusion of students who may not be able to participate in traditional P.E. classes.”

Recommendations:

As we look to new ways to help more students become successful in school and life, we must focus on more than just what is learned academically. We must look comprehensively at what is fun and good for kids, what responds to their different needs, abilities, dispositions, background, and predicaments, what addresses their uniqueness, and what helps to connect the inter-relationships and intersections of learning to the brain and body. The following recommendations are offered:

- Identify and incorporate innovative ways to engage students differently when it comes to visual, auditory, and kinesthetic learning, including the use of technology in health and physical education. For example, presenting material kinesthetically/tactilely will insure that each lesson is connecting to an often-omitted learning preference of many students; incorporating strategies, such as game-based learning, which can interactively link active learning to physical education, health and academic outcomes.
- Connect academics and physical education to real-world experiences with the understanding that making connections to core subject matter is crucial to short and long-term outcomes. For example, a lesson can support learning mathematical concepts, while presenting numbers concepts and operations at various levels of difficulty, while addressing motor, fitness, movement, manipulative, spatial, safety, and collaboration, team skills, etc.
- Examine the importance and benefits of focusing on the parts of the brain where learning occurs; for example, motor skills, spatial ability, coordination, mindfulness, organization, and social interaction. Appropriately extend and adapt physical activity offerings to all children, including those with disabilities and mobility challenges.

About Dr. Searetha Smith

Searetha Smith-Collins is Chief Education Officer at Lü Interactive Playground. She has worked in several urban and suburban school districts as Chief Academic Officer, Associate Superintendent of Instruction and Accountability, Executive Director of Curriculum and Instruction, school principal and teacher. She helps district, school leaders, and business leaders identify which resources, including instructional technology, are effective, which may be underutilized, and which, with greater guidance and use, may improve student outcomes. As author and presenter, her interest is in addressing equity, policy and education issues related to identifying how to tap into the genius of every child.

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